THE INSECTS ON A SMALL, ISOLATED, DERELICT METALLIFEROUS MINE SITE IN CORNWALL

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Wheal Johnny is an old mine site at Kehelland in west Cornwall near Camborne, about 2 kilometres from the sea at an altitude of 80 metres. It was a small-scale copper, silver and lead mine, well-capitalized between 1878 and 1887, and has been abandoned for 108 years (Buckley, pers. comm.). It was part of a larger complex of mines, to which it would have been connected by tracks or tramways. The mine shaft was 60 fathoms, with a pumping engine in site. Wheal Johnny is now an ecological island (about 0.7 hectares) in an agricultural landscape, being surrounded by fields; access is by a lane from the nearby road. The nearest similar habitat is about 200 metres across a field. The old mine has left a hummocky terrain around an old shaft. The site has been colonised by *Ulex europaeus* L. scrub, with some *Salix cinerea* L. and *Rubus fruticosus* L. agg. in the lower areas. Around the shaft there is a considerable amount of bare ground, which has been compacted by industrial activity; there is some loose clinker on the surface, remnants of slag from smelting. Contamination of the ground in places is shown by surface discoloration. Parts of this area have been colonized by *Calluna vulgaris* (L.) Hull, and form relict heathland. Nectar sources for insects are chiefly provided by *Ulex europaeus* and *Calluna vulgaris*, but there was also *Sedum anglicum* Hudson, *Lotus corniculatus* L., *Hypochaeris radicata* L., *Digitalis purpurea* L., *Gladiolus byzantinus* (Miller) A. P. Hamilton (a garden escape) and some *Crataegus monogyna* Jacquemont. These mine sites have been shown to be nationally important for wildlife (e.g. Bradshaw & Chadwick, 1980; Box, 1992; D.O.E., 1994), especially in Wales (Johnson, Putwain & Holliday, 1978) and in Cornwall (Spalding, 1995). Most survey work on derelict land sites has been done on higher and lower plants, mammals and birds, although some work has been done on invertebrates (e.g. Coldwell, 1993 and Fowles, 1994). The bryophytes of Wheal Johnny have been surveyed (Holyoak, 1995) although nothing of great importance was discovered. Despite the small area of the site, it was found to be of considerable interest for insects during a special survey in 1994–5.

Methods

This survey formed part of a larger survey of metalliferous mine sites in west Cornwall. Wheal Johnny was visited by day on 11 and 23.viii.1994, 24.iv.1995, 4.v.1995, 6.vi.1995 and 10.viii.1995; no more than 1 hour was spent on the site at any one time. Recording was by observation, sweeping and netting of flying insects. There was no trapping by mercury vapour lamp. Difficult species were collected for examination at home. Mining bees were identified by Mike Edwards and E.C.M.H. Total population counts were made of the grasshopper *Myrmeleotettix maculatus* (Thunb.) on 23.viii.1994 and 10.viii.1995; this was done by collecting all specimens seen which were then released unharmed at the end of the count.

Results

Species of insect recorded included 32 Lepidoptera, four Orthoptera, two Neuroptera, one Dermaptera, 10 Hemiptera, 16 Hymenoptera, 16 Diptera and four Coleoptera. They are listed in the Appendix.

Of these, six were heathland species and five were bare-ground specialists; some of these are sedentary insects almost certainly resident here (Table 1). There were large populations of the moth *Cydia succedana* D.& S. on the gorse bushes, and the moth *Agonopterix nervosa* Haw. was also recorded here. Heathland insects included the moth *Eupithecia nanata* Hübn, the Heteropteran bug *Alydus calcaratus* (L.) and the grasshopper *Myrmeleotettix maculatus*. The population of *Myrmeleotettix maculatus*, according to counts in 1994 and 1995, was apparently stable but very small (Table 2). Six *Tettigonia viridissima* L. were found in 1995, although none were seen in 1994.

Discussion

The insects recorded here can be divided into two classes: resident, sedentary species and mobile, adventive species. The presence of resident, sedentary species (Table 1) indicates long-term historical continuity. Species such as *Myrmeleotettix maculatus* indicate that the site is of possible high quality for invertebrates and should be investigated further (Spalding & Haes, 1995). *Myrmeleotettix maculatus* although winged is not a mobile species. Its presence here indicates that there was extensive heathland present when mining activity started here and that a small area of heathland has survived here ever since. The same is probably true for *Alydus calcaratus*. It is one of the fastest flying of all the British Heteroptera (Southwood & Leston, 1959), but has a close association with dry heathland. It may also occur on the nearby mine site which lies about 200 metres east of Wheal Johnny, but it is otherwise now isolated in this vicinity. The same may be true for the two moth species in Table 1.

An interesting find was the nationally rare green variety of the grasshopper *Chorthippus brunneus* (Thunb.). This form has been recorded regularly on the

Table 1. Resident, sedentary species recorded at Wheal Johnny.

Alydus calcaratus	(Hemiptera, Heteroptera)
Ematurga atomaria	(Lepidoptera)
Eupithecia nanata	(Lepidoptera)
Myrmeleotettix maculatus	(Orthoptera)
Ulopa reticulata	(Hemiptera, Homoptera)

Table 2. Population of *Myrmeleotettix maculatus* at Wheal Johnny 1994–5.

Date of count	23.viii.94	10.viii.95
Females	6	7
Males	7	7
Total	13	14

calcareous dunes along the nearby coast, but this is the first Cornish inland, non-dune record for this distinctive variety. It would be significant if found at other metalliferous mine sites, as it could be linked with the presence of normally maritime/boreal relict plants such as *Armeria maritima* (Miller) Willd. and *Plantago maritima* L., which are widespread on larger mine sites in Cornwall (although not on this site).

The large bush-cricket *Tettigonia viridissima* has a minimum 2-winter dormancy in the egg stage. It is likely that a small population here produces adults only in odd years, which explains why none were seen in 1994. However, as the species is widespread on wasteland and in larger gardens and Cornish hedges in the district, the specimens seen in 1995 could be the progeny of an itinerant gravid female in 1993. This site certainly appears to provide suitable habitat for *Tettigonia viridissima*, which needs scrub as an adult but bare ground for laying and coarse herbage for nymphs.

Bare compacted ground is typical of the contaminated slag heaps at mine sites and can be relatively extensive, even around a small isolated site such as Wheal Johnny. It can be a significant habitat for invertebrates in its own right. It provides two key requirements: warm basking sites, especially for the Orthoptera, diurnal Lepidoptera and Hymenoptera, and nesting sites particularly for solitary Hymenoptera and in consequence a hunting ground for their invertebrate predators (Kirby, 1992; Fry & Lonsdale, 1991). During the survey at Wheal Johnny insects observed using bare sun-warmed slag for basking included *Lasiommata megera* L., a species noted for perching on bare ground (Thomas, 1991), and a transient *Macroglossum stellatarum* L. Hymenoptera clearly associated with this habitat at the site were the ant *Lasius niger* (L.) and the solitary bees *Andrena haemorrhoa* (F.), *Lasioglossum smeathmanellum* (Kirby) and *Panurgus banksianus* (Kirby) (a locally frequent species around the Cornish coast). A cuckoo bee *Nomada fabriciana* (L.) was probably attracted to the nest burrows of some or all of these bees. A widespread solitary wasp *Mellinus arvensis* (L.) was seen nectaring on flowers in the vicinity, although no nest burrows were located; it is also a bare-ground nesting species, stocking its nests with hoverflies, some of which were numerous here.

One insect readily using the bare ground for basking was *Myrmeleotettix maculatus*. Although this distinctive grasshopper can be very numerous on extensive dune, heath or large mine-tip sites, it is also able to persist in tiny populations, so long as the habitat remains suitably open and exposed to the sun (Marshall & Haes, 1988). Wheal Johnny supported what was clearly just such a small population. The opportunity was therefore taken to estimate the population size of this relatively easily studied insect, partly to demonstrate one facet of the natural history of this site which could be useful for educational purposes. The remarkable closeness in the counts in two successive years (Table 2) indicates a very stable population. Future counts of this grasshopper would prove invaluable for indicating the general stability of the bare ground and associated heathland at this isolated but accessible site.

Heathland is an important but declining wildlife habitat in Cornwall, as elsewhere in north-west Europe. Even a small area, as at Wheal Johnny, justifies careful investigation. At this site the dominant plant of the heathland area is *Calluna vulgaris*. This plant is tolerant of metal contamination and grows well on toxic compacted ground where other plants cannot survive. *Calluna vulgaris* is an important nectar source in the second half of the summer for a wide variety of insects (hence the siting of bee-hives at Wheal Johnny). Six species of bumble-bee,

several solitary Hymenoptera and Lepidoptera, and six kinds of hoverfly were recorded nectaring on the blossom. Insects recorded here, which depend on *Calluna vulgaris* as a foodplant, include the flightless leafhopper *Ulopa reticulata* (F.), the leaf beetle *Lochmaea suturalis* (C. G. Thomson) and the larvae of the moths *Ematurga atomaria* L. and *Eupithecia nanata*. *Myrmeleotettix maculatus* feeds on the adjacent stunted grasses and *Alydus calcaratus* is an active predator in this habitat. Unfortunately, part of this small area of heath was landscaped by grading and grassing when the mine shafts were capped during winter of 1994/5, despite the fact that the importance of the bare ground/heathland area for wildlife was emphasized to the district council. No *Myrmeleotettix maculatus* were seen on the "improved" area in 1995. It is still unfortunately true that bare ground is considered by many to be inimical to nature conservation.

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Appendix. List of insects recorded at Wheal Johnny 1994/1995

Orthoptera
Tettigonia viridissima L.
Chorthippus brunneus (Thunb.)
Chorthippus parallelus (Zett.)
Myrmeleotettix maculatus (Thunb.)

Dermaptera
Forficula auricularia L.

Hemiptera Heteroptera
Piezodorus lituratus (F.)
Palomena prasina (L.)
Dolycoris baccarum (L.)
Alydus calcaratus (L.)
Nysius thymi (Wolff)
Nabis rugosus (L.)
Anthocoris nemorum (L.)

Hemiptera Homoptera
Ulopa reticulata (F.)
Eupteryx sp.
Philaenus spumarius (L.)

Neuroptera
Chrysoperla carnea (Steph.)

Mecoptera
Panorpa communis (L.)

Lepidoptera

a) Butterflies
Thymelicus sylvestris (Poda)
Ochlodes venata (Bremer & Grey)
Pieris brassicae (L.)
Pieris rapae (L.)
Pieris napi (L.)
Lycaena phlaeas (L.)
Polyommatus icarus (Rott.)
Vanessa atalanta (L.)
Cynthia cardui (L.)
Aglais urticae (L.)
Inachis io (L.)
Pararge aegeria (L.)
Lasiommata megera (L.)
Pyronia tithonus (L.)
Maniola jurtina (L.)
Coenonympha pamphilus (L.)

b) moths
Zygaena filipendulae (L.)
Agonopterix nervosa (Haw.)
Eupoecilia angustana (Hübn.)
Epiphyas postvittana (Walk.)
Cydia succedana (D.&S.)
Macrothylacia rubi (L.)
Euthrix potatoria (L.)
Eupithecia nanata (Hübn.)
Pseudopanthera macularia (L.)
Ematurga atomaria (L.)
Macroglossum stellatarum (L.)
Arctia caja (L.)
Phragmatobia fuliginosa (L.)
Tyria jacobaeae (L.)
Diarsia rubi (Vieweg.)
Autographa gamma (L.)

Diptera
Tipula oleracea L.
Bibio marci (L.)
Dilophus febrilis (L.)
Chloromyia formosa (Scop.)
Syrphus ribesii (L.)
Leucozona lucorum (L.)
Rhingia campestris Meig.
Episyrphus balteatus (Deg.)
Merodon equestris F.
Eristalis tenax (L.)
Eristalis pertinax (Scop.)
Eristalis arbustorum (L.)
Urophora cardui (L.)
Tachina fera (L.)
Scathophaga sp.
Sarcophaga sp.

Hymenoptera
Lasius niger (L.)
Lasius flavus (F.)
Mellinus arvensis (L.)
Vespula vulgaris (L.)
Vespula rufa (L.)
Andrena haemorrhoa (F.)
Lasioglossum smeathmanellum (Kirby)
Panurgus banksianus (Kirby)
Nomada fabriciana (L.)
Apis mellifera L.
Bombus terrestris (L.)
Bombus lucorum (L.)
Bombus hortorum (L.)
Bombus lapidarius (L.)
Bombus pascuorum (Scop.)
Bombus pratorum (L.)

Coleoptera
Coccinella 7-punctata L.
Oedemera nobilis (Scop.)
Lochmaea suturalis (C. G. Thomson)
Apion ulicis (Forst.)